Learn EveryWare

Math 6 Unit 4

Student Learning Guide

pilot®

Alberta Education

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Creator
Wayne Poncia

Author
Michelle Gainer

Contributing Authors
Grant Mellemstrand
Lisa Read
Nancy Claire Duchaine
Pat Giommi

Senior Editor
Dr. Mary Ellen Bafumo

Editor
Mary Dillon

Production Manager
Sandi van Katwijk

Print Design Coordinator
Carrie Todd

Animators
Rob Jones
Stephen McCallum

Multimedia Designer
Tyler Pantella

Senior Developer
Leo Shen

Publisher K - 12
Dr. Barry Carbol

Publisher Professional Development
Dr. Elizabeth Childs

Math Editors
Harvey Knapp
Wayne Loutet

Project Coordinator
Julia Schenck

Product Coordinator
Robert Bailey

Production Designers
Antonio Escudé
Francisco Cumayas
Liviu Peicu
Sherif Sidky

Flash Developers
Harry Kim
Ryan Thomson

Illustrators
Antonio Escudé
Carrie Todd
Francisco Cumayas
Ingrid Mesquita
Liviu Peicu
Sherif Sidky

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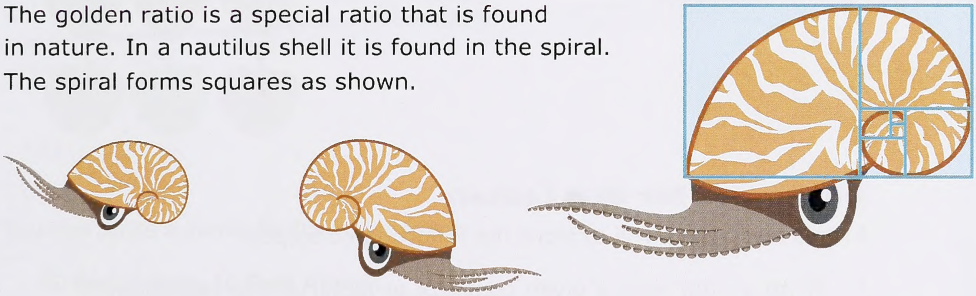
Lesson 1

Ratio

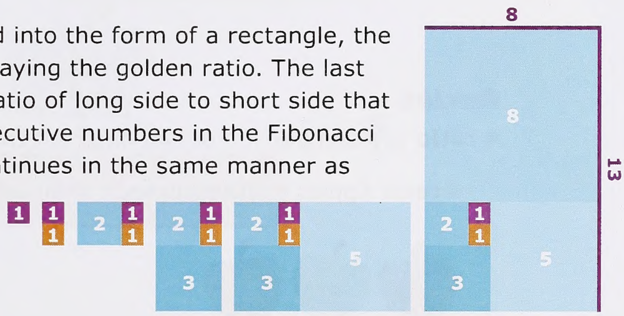
Golden Ratio

The golden ratio is a special ratio that is found in nature. In a nautilus shell it is found in the spiral. The spiral forms squares as shown.



The rectangle formed reflects a combination of the squares generated using the **Fibonacci sequence**.

As more squares are generated into the form of a rectangle, the rectangle comes closer to displaying the golden ratio. The last rectangle in this image has a ratio of long side to short side that is 13 to 8. These are two consecutive numbers in the Fibonacci sequence. The golden ratio continues in the same manner as the Fibonacci sequence.



The golden ratio is so pleasing to the eye that it has also been used in architecture and art.

Reflection

How is the rectangle for the golden ratio similar to items in your home?

Objectives for this Lesson

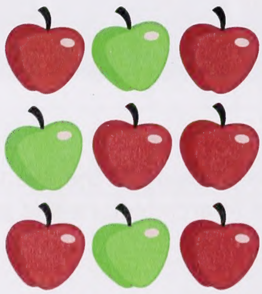
In this lesson you will explore the following concepts:

- Write a ratio from a given concrete or pictorial representation
- Express a given ratio in multiple forms
- Provide a concrete or pictorial representation for a given ratio

Ratios

A **ratio** is a comparison of two different things.

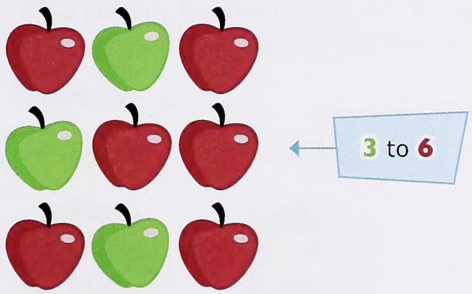
Green Apples to **Red** Apples



You can write a ratio in three different ways.

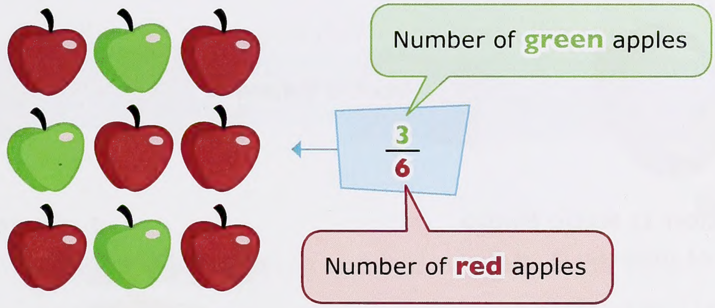
You can write a **ratio in word form**. Use the word "to" between the two things being compared.

Green Apples to **Red** Apples



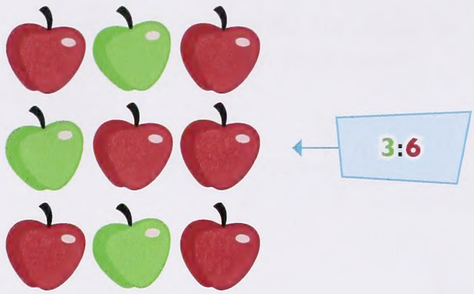
You can write a **ratio in fraction form**.

Green Apples to **Red** Apples



You can write a **ratio in ratio form**. This form uses a colon between the two numbers being compared.

Green Apples to **Red** Apples



For all three forms you would read the ratio of green apples to red apples as "three to six".

Let's Explore

Exploration 1: Ratio Bingo

Number of players: 2 to 4

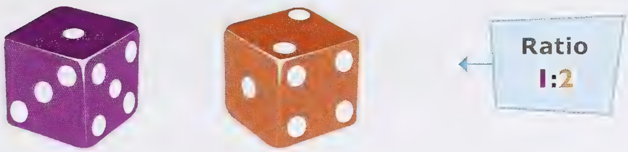
Materials: Unit 4, Lesson 1, Exploration 1 page in your Workbook, Blank Bingo Card from the back of this Unit in your Workbook, Pencil, Dice, Pennies or Counters

Play:

1. Have each player choose 24 ratios from the given list and fill in their Bingo card.
2. On a player's turn he or she rolls the dice one at a time.
   The ratio is the number on the first die to the number on the second die.

   Example:

   First Die **Second Die**



3. The ratio rolled is marked on all players' cards, using a penny or counter, if it appears.
4. Pass the dice to the next player and repeat the process.
5. The first player to get a Bingo wins.

Example 1

Write the ratio of blue stars to white stars in ratio form.

There are 6 blue stars. There are 4 white stars. The ratio is: **6:4**

Example 2

There are 7 geese and 4 ducks in a lake at the park. Express the ratio of geese to ducks in three ways.

Write the ratio in words.

geese to ducks

Write the ratio in word form. Replace the word geese with the number of geese. Replace the word ducks with the number of ducks.

7 to 4

Write the ratio in fraction form. The number of geese should be in the numerator and the number of ducks in the denominator.

$$\frac{7}{4}$$

Write the ratio in ratio form.

7:4

Let's Explore

Exploration 2: Making Ratios

Materials: Unit 4, Lesson 1, Exploration 2 page in your Workbook, Two Sets of 12 Different Items, Pencil

Samples of two sets of 12 different items:

- 12 buttons and 12 beans
- 12 paperclips and 12 blocks
- 12 pencil crayons and 12 small squares of paper

For 1 – 4: Create a model on your desk of each ratio using your two sets of different items. Draw your model, and list the ratio in words.

1. **3:5** 2. **2:4** 3. **5:3** 4. **4:2**

For 5 – 7: Create 3 models of ratios using your two sets of different items. Draw your models. Write the ratio you created in words and in ratio form.

5. **Ratio:** ____________________

   Words: ____________________ to ____________________

6. **Ratio:** ____________________

   Words: ____________________ to ____________________

7. **Ratio:** ____________________

   Words: ____________________ to ____________________

For 8 – 12: Either record an oral answer or write one in your Workbook. If recording, follow the recording instructions in your Workbook.

8. How is your model of number 2 like the model of number 4?
9. How are the ratios of numbers 2 and 4 different?
10. How is your model of number 1 like the model of number 3?
11. How are the ratios of numbers 1 and 3 different?
12. Reflect: Is order important when dealing with a ratio? Why or why not?

Let's Practice

- Go online to watch the Notepad Tutor Lesson: Understanding Ratios.
- Turn in your Workbook to Unit 4, Lesson 1 and complete 1 to 22.

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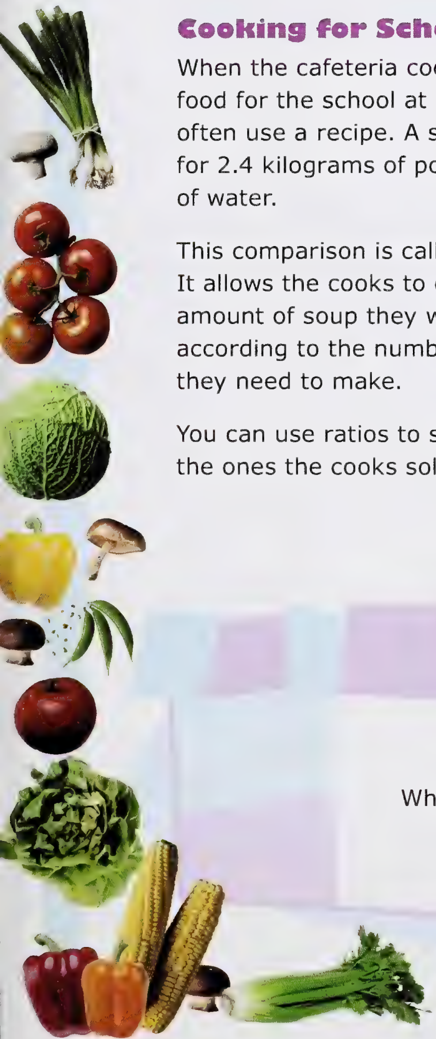
Lesson 2

Problem Solving with Ratios

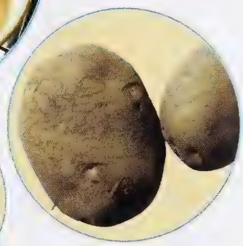


Cooking for School Lunch

When the cafeteria cooks prepare the food for the school at lunch, they will often use a recipe. A special soup calls for 2.4 kilograms of potatoes to 12 litres of water.

This comparison is called a ratio. It allows the cooks to change the amount of soup they will prepare according to the number of meals they need to make.

You can use ratios to solve problems like the ones the cooks solve every day.



Reflection

What are other ratios that you have encountered?

Lesson 2: Problem Solving with Ratios

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Identify and describe ratios from real-life contexts
- Explain the part to whole and part to part ratios of a set
- Solve a given problem involving ratio

- Go online to watch the Notepad Tutor Lesson: Fractions as Parts of a Whole or Set.

Ratios that Compare a Part to a Part

A ratio is a comparison of two numbers. The major difference between a fraction and a ratio is that you can have a part compared to a part of a group or whole with a ratio. Fractions are used to compare a part to a whole.

What **fraction** of the triangles are orange?
What is the **ratio** of orange triangles to white triangles?

Fraction

Part

$\frac{4}{6}$

Whole

Ratio

Part 4 to 2 Part

Example 1

Some students were asked to identify their favourite type of book. The data recorded from the survey appears in the chart below. Write the requested ratio in three ways.

Favourite Type of Book	
Book Type	**Number of Responses**
Mystery	12
Biography	5
History	8
Romance	9
Fantasy	6

a. Students who prefer biography books to students who prefer history books

In word form: **5 to 8**

In ratio form: **5:8**

In fraction form: $\frac{5}{8}$

b. Students who prefer romance books to students who prefer mystery books

In word form: **9 to 12**

In ratio form: **9:12**

In fraction form: $\frac{9}{12}$

c. Students who prefer fantasy books to students who prefer biography books

In word form: **6 to 5**

In ratio form: **6:5**

In fraction form: $\frac{6}{5}$

Ratios that Compare a Part to a Whole

A fraction compares a part to a whole or to a group. A ratio is a comparison of two numbers and can do the same thing. You can compare parts to a whole using ratios or fractions.

What fraction of the triangles are orange?
What is the ratio of orange triangles to the total number of triangles?

Fraction

Part

$\frac{4}{6}$

Whole

Ratio

Part 4 to 6 Whole

Example 2

Some students were asked to identify their favourite type of book. The data recorded from the survey appears in the chart below. Write the requested ratio in three ways.

Favourite Type of Book	
Book Type	**Number of Responses**
Mystery	12
Biography	5
History	8
Romance	9
Fantasy	6

a. Students who prefer fantasy books to total number of students who responded

6 students prefer fantasy books in the survey.

Find the total number of students who responded:

12 + 5 + 8 + 9 + 6 = 40 student responses

In word form: **6 to 40**

In ratio form: **6:40**

In fraction form: $\frac{6}{40}$

b. Students who prefer history books to total number of students who responded

In word form: **8 to 40**

In ratio form: **8:40**

In fraction form: $\frac{8}{40}$

c. Students who prefer biography books to total number of students who responded

In word form: **5 to 40**

In ratio form: **5:40**

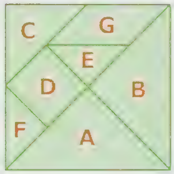
In fraction form: $\frac{5}{40}$

Let's Explore

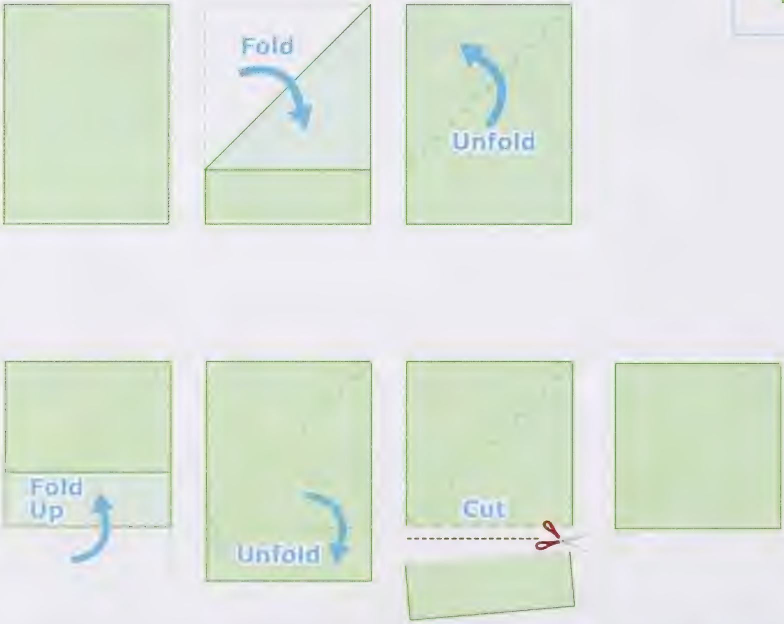
Exploration 1: Creating Tangrams

Materials: Unit 4, Lesson 2, Exploration 1 page in your Workbook, A Rectangular Piece of Paper, Scissors, Straight Edge (optional)

Tangram



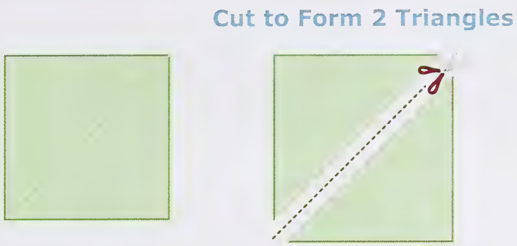
Tangrams are special manipulatives that have relationships among the size of the pieces. You can make your own set using these steps:



This is the large square.

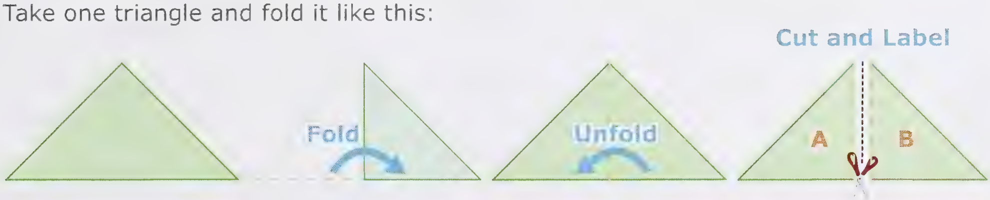
All of the tangram pieces fit together like a puzzle to form this square.

The square is equal in area to two large triangles.



The ratio of the area of the large triangle to the area of the large square is **2:1**.

Take one triangle and fold it like this:

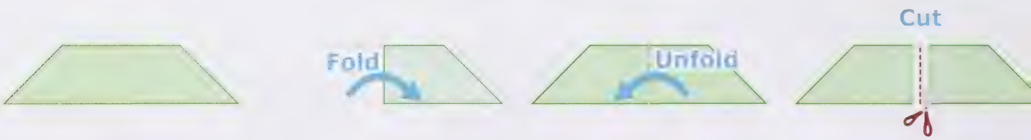


Now you have two small triangles.
The area of one of these small triangles to the area of the large square is **4:1**.

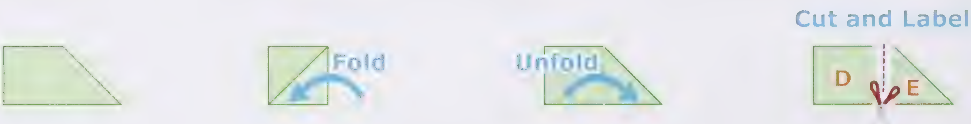
Take the other large triangle and fold it like this:

The ratio of this triangle to Triangle A is **2:1**.

Take the trapezoid from the last step and fold it in half and then cut along the fold:

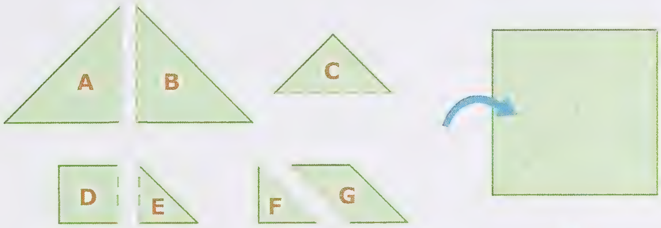


Take one of the small trapezoids:



Take the other small trapezoid:

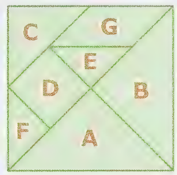
Now you have all the pieces of the Tangram puzzle:



This is the large square.

All of the tangram pieces fit together like a puzzle to form this square.

Tangram



For 1 – 7: Use the Tangram pieces to write the ratios in ratio form and fraction form.

	Ratio of the areas of...	Ratio form	Fraction form
1.	the whole large square to **A**		
2.	the whole large square to **B**		
3.	the whole large square to **C**		
4.	the whole large square to **D**		
5.	the whole large square to **E**		
6.	the whole large square to **F**		
7.	the whole large square to **G**		

For 8: Either record an oral explanation or write one in your Workbook. If recording, follow the recording instructions in your Workbook.

8. Reflect: Explain your reasoning for the ratio of the whole square to the area of G.

Solve Problems Using Ratios

Ratios help you to predict numbers for a larger real life situation.
The problem solving strategy of guess-and-check is part of the process.
You will also use your ability to extend patterns in a table.

Example 3

Zack is making a casserole with his dad. The recipe calls for 4 servings of water for each serving of pasta. Use the ratio table to find how many servings of water should be used for 5 servings of pasta.

Servings of Pasta	1				5
Servings of Water	4				?

One way to solve: Extend a pattern

For 2 servings of pasta you will need 4 + 4 = 8 servings of water.
Continue this pattern until you have reached 5 servings of pasta.

		+1	+1	+1	+1
Servings of Pasta	1	2	3	4	5
Servings of Water	4	8	12	16	20
		+4	+4	+4	+4

Another way to solve: Multiply each value by the same number

		•5
Servings of Pasta	1	5
Servings of Water	4	20
		•5

The ratio is 5 servings of pasta to 20 servings of water.

Sometimes the value you are trying to find is smaller than the original value in a ratio. In that case you will use guess–and-check.

Example 4

An apartment building has 8 apartments to 32 windows.
How many windows does one apartment have if they all have the same number of windows?

Apartments	8	4		1
Windows	32			?

List the factors of 8: 1, 2, 4, 8

Guess which factor you can use to divide 8 by to get 4: 2

Now divide both values of the ratio by 2 until you get to 1 apartment:

		$\div 2$	$\div 2$	$\div 2$
Apartments	8	4	2	1
Windows	32	16	8	4
		$\div 2$	$\div 2$	$\div 2$

Check: Since the answers properly complete the table, your guess was correct.

One apartment has four windows.

Let's Practice

- Go online to complete the Concept Capsule: Basic Problem Solving with Ratios.
- Turn in your Workbook to Unit 4, Lesson 2 and complete 1 to 15.

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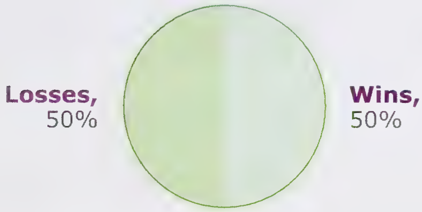
Lesson 3

Percents as a Ratio or Fraction

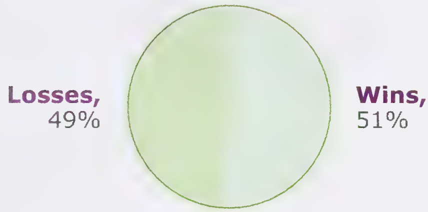
Hockey Results

In the 2007 – 2008 NHL season the Edmonton Oilers won 41 games out of the 82 games they played. The Calgary Flames won 42 out of the 82 games in their regular season. One way to report the results is using percents. Percents are special ratios that help you to know what part of a group has occurred.

Edmonton Oilers
2007-08

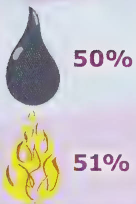


Calgary Flames
2007-08



The Edmonton Oilers won 50 percent or 50% of their games. The Calgary Flames won 51 percent or 51% of their games.

Reflection



How does knowing the percent of games won help you compare the season of each team?

Lesson 3: Percents as a Ratio or Fraction

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Explain what percent means
- Use concrete materials and picture models to illustrate a given percent
- Record the percent displayed in a given concrete or pictorial representation

Part of 100

You may remember working with 10 by 10 squares when working with decimals. You can use hundred squares to make models for fractions and ratios.

Let's Explore

Exploration 1: Making Parts of 100

Materials: Unit 4, Lesson 3, Exploration 1 page in your Workbook, Pencil or Pencil Crayons

1. Make a model for each of the following ratios:

   a. 40:100 b. 35 to 100 c. 18:100 d. 45:100

2. Make a model for each of the following fractions:

   a. $\frac{85}{100}$ b. $\frac{20}{100}$ c. $\frac{28}{100}$ d. $\frac{65}{100}$

3. Alyssa shaded 25 squares in a 10 by 10 square. What is a ratio for her shaded squares to the white squares?

4. Complete the statement: Alyssa shaded ______ parts of 100.

5. Daksha shaded 50 squares in a 10 by 10 square. What is a fraction for his shaded squares?

6. Complete the statement: Daksha shaded ______ parts of 100.

The Meaning of Percent

The word **percent** means "part of 100". A percent is another way of expressing a fraction, decimal, or ratio. To write a percent in symbols you will use a percent sign.

% means "percent"

Here are three ways to write the shaded part of 100:

46 Shaded Squares

Ratio	Fraction	Percent
46:100	$\frac{46}{100}$	46%

Modelling Percents

As you saw, you can use 10 by 10 squares to model percents. You can also use Percent Strips and Circles.

Let's Explore

Exploration 2: Modelling Percents

Materials: Unit 4, Lesson 3, Exploration 2 page from your Workbook, Percent Strips, and Percent Circles from the back of this Unit in your Workbook, Scissors, Glue or Tape, Pencil

1. Label the following strips with the percentage that is shaded.

a.  = ____________ %

b.  = ____________ %

c.  = ____________ %

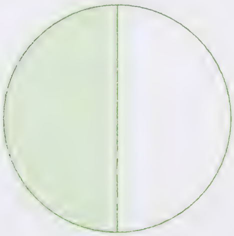
2. Cut out the Percent Strips from your Workbook.

3. Using the Percent Strips, model the given percents. Paste your models on the Workbook page, in the strip provided. The strip represents 100%.

   a. Alyssa scored 85% on her last math test.

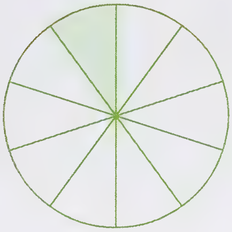
   b. Cameron's mother saved 20% on the school supplies she purchased.

4. Label the following circles with the percentage that is shaded.

   a.  = ________%

   b.  = ________%

c.



= ________%

5. Cut out the Percent Circles from your Workbook.

6. Using the Percent Circles, model the given percents. Paste your models on the Workbook page, in the circle provided. The circle represents 100%.

   a. Nina is able to get a goal 45% of the time she shoots the puck.

   b. Zach has earned 35% of his summer money.

   c. Lian planted 50% of the garden.

Example 1

Write a ratio, fraction and a percent for the given model.

There are 48 shaded squares out of 100 squares.

Ratio: **48 to 100**

Fraction: $\frac{48}{100}$

Percent: **48%**

Example 2

Write the ratio 30:100 as a fraction and as a percent.

The ratio is 30 to 100.

As a fraction this is: $\frac{30}{100}$

As a percent this is: 30 parts of 100 or **30%**.

Let's Practice

- Go online to watch the Notepad Tutor Lesson: Percents as Ratios and Fractions.

- Turn in your Workbook to Unit 4, Lesson 3 and complete 1 to 17.

Math 6 Unit 4

Lesson 4

Percents as a Decimal

Retail Discount

When a retailer discounts merchandise for their store they use a markdown rate. Retailers use various methods to advertise discounts. Rather than change the original price tag, they will sometimes use percentage discounts. This lets customers know what portion of the original price they will pay.

When you see a sale sign that says "25% Off" that means that the price is reduced by 25% of the regular cost.

Reflection

What types of sales signs have you seen with percents in the message?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Express a given percent as a decimal
- Create a model for a given percent
- Identify and describe percents from real-life contexts

Percents and Decimals

A **percent** is a part of one hundred.

60% is **60** parts of **100**

Another way of expressing a percent is as a decimal. Ratios, fractions, decimals, and percents can all be used to express the same value.

Ratio	Fraction	Decimal	Percent
25:100	$\frac{25}{100}$	0.25	25%

Example 1

Write the decimal and percent for the shaded region.

The decimal is based on place value. There are one hundred small squares in the figure. Each represents one hundredth.

You can count the squares to see that the shaded region is 78 squares. As a decimal this is:

Tens	Ones	.	Tenths	Hundredths
		.	7	8

78 hundredths or **0.78**

As a percent this is:

78 parts of 100 or **78%**

You can also create a model for a given percent.

Let's Explore

Exploration 1: Modelling Percents

Materials: Unit 4, Lesson 4, Exploration 1 page in your Workbook, Calculator, Pencil

For 1 – 6: Convert each part-whole combination into a decimal:
part ÷ whole = decimal

		Part	Whole	Decimal
1.	Daksha's Video Games	12 Music	15 Total	
2.	Alyssa's Family's Trophies	5 Hockey	20 Total	
3.	Nina's Balls	12 Tennis	30 Total	
4.	Cameron's Books	8 Mystery	50 Total	
5.	Zach's Shirts	9 Navy	10 Total	
6.	Lian's Tools	2 Hammers	40 Total	

For 7 – 12: Write each decimal in the chart as a percent.

		Part	Whole	Decimal	Percent
7.	Daksha's Video Games	12 Music	15 Total		
8.	Alyssa's Family's Trophies	5 Hockey	20 Total		
9.	Nina's Balls	12 Tennis	30 Total		
10.	Cameron's Books	8 Mystery	50 Total		
11.	Zach's Shirts	9 Navy	10 Total		
12.	Lian's Tools	2 Hammers	40 Total		

13. Create a model for each percent listed in the chart.

- Go online to complete the Concept Capsule: Pictorial Representations of Percents.

Example 2

Write the following as a decimal and a percent:

There are 205 people with seats out of 245 people in the auditorium.

Write a decimal:

part ÷ whole = decimal

$205 \div 245 =$

Use a calculator:

2 0 5 ÷ 2 4 5 = 0.836734

You will need to round to the hundredths place: **0.84**

Write the percent:

This is about 84 parts of 100, or **84%**.

Why Percents?

Percents are often used to compare two or more things that have a different whole. For instance:

Daksha won 6 out of the first 12 games he played in hockey this season.

Alyssa won 4 out of the first 7 games she played in hockey this season.

Who has the better record? You cannot really tell by comparing 6 and 4. That doesn't tell you the number of games that were played.

You can compare percents:

Daksha won 50% of his games so far this season.

$6 \div 12 = 0.50 = \mathbf{50\%}$

Alyssa won about 57% of her games so far this season.

$4 \div 7 \approx 0.571 \approx \mathbf{57\%}$

Now you can see that Alyssa has a better record at this point in the season.

Let's Explore

Exploration 2: Comparing Parts

Materials: Unit 4, Lesson 4, Exploration 2 page in your Workbook, Pencil

1. Create three situations that involve percents. They can be from your every day life. Here are some ideas:
   - Give a survey
   - Track the use of something in your home
   - Record the wins and losses for a game you play with a family member or friend, etc.
2. Write the part and whole for each situation, as well as the decimal and percent.

Let's Practice

- Turn in your Workbook to Unit 4, Lesson 4 and complete 1 to 22.

Lesson 5

Solving Problems Using Percents

Buffalo Jump

Many of the Siksika First Nation now live in Southern Alberta on reserves. For centuries, they roamed the area between the North Saskatchewan River in Alberta to the Yellowstone River in Montana.

The Siksika were very resourceful in hunting Buffalo. The members of the hunting party would surround buffalo herds on three sides and drive the buffalo over the side of a cliff. The tribes would then gather the meat from the buffalo at the bottom of the cliff.

If 10% of 100 buffalo jumped off the side of a cliff, how many buffalo jumped?

Reflection

How can you find the percent of a number using decimals?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Solve a given problem involving percents
- Determine an appropriate type of graph for displaying a set of collected data, and justify the choice of graph

Percent of a Number

You can find the percent of something using 10 by 10 squares which represent the whole. You have already used them to identify percents. Each unit square in the whole represents **one** out of the 100 squares.

1 out of 100 or 1%

You can also use the 10 by 10 squares to help define a part of a number other than 100. Use the Exploration to find the percent of a number.

Let's Explore

Exploration 1: Percent of a Number

Materials: Unit 4, Lesson 5, Exploration 1 page in your Workbook, Pencil

For 1 – 3: Graph the following percents on the 10 by 10 squares in your Workbook.

1. 30%
2. 25%
3. 75%
4. A 10 by 10 square represents 100 people. How many people does one unit of the square represent?
5. A 10 by 10 square represents 1 000 people. How many people does one unit of the square represent?
6. A 10 by 10 square represents 500 people. How many people does one unit of the square represent?

For 7: Either record an oral explanation or write one in your Workbook. If recording, follow the recording instructions in your Workbook.

7. Reflect: Explain your answer to number 6.
8. Find the following using your 10 by 10 squares from 1 – 3, and the answer to number 6.

   a. 30% of 500 people

   b. 25% of 500 people

   c. 75% of 500 people

You can find 1% of a number using a 10 by 10 square:

Since 1 out of 100 is 1%, each of the values for the unit squares above is 1% of the number the whole square represents:

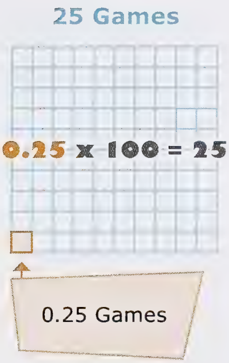
> 5 people is 1% of 500 people
> 0.45 games is 1% of 45 games
> 0.04 apples is 1% of 4 apples

This reasoning can help you find the percent of a number.

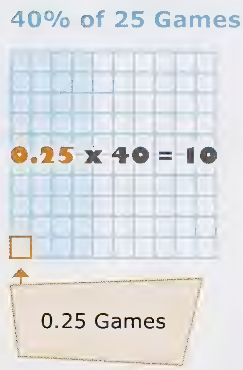
Example 1

The Riverhawks Hockey Team won 40% of the 25 games they played.
How many games did they win?

Use a 10 by 10 square to find 1% of 25 games:



Now multiply the value of each unit square by 40 to find 40%:



40 unit squares have a value of **10**.

The Riverhawks won **10** games.

Another method for finding the percent of a number is using its decimal form. The decimal form of a percent can be multiplied by the number to find the percent.

Example 2

Alyssa has 75% as many trophies as her older brother. If her brother has 16 trophies, how many does Alyssa have?

Write the percent as a decimal.

75% = **0.75**

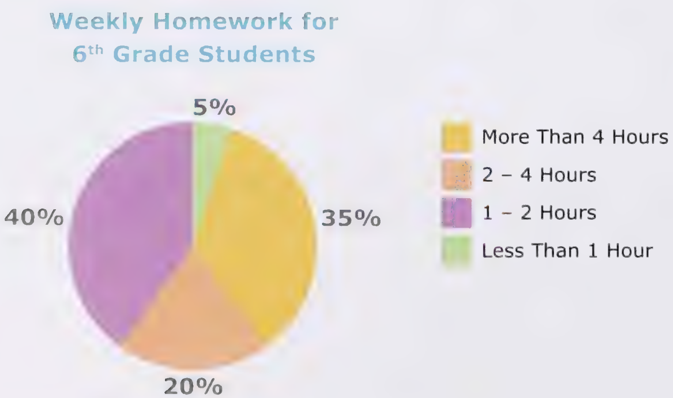
Multiply the decimal by the number:

0.75(16) = **12**

Alyssa has **12** trophies.

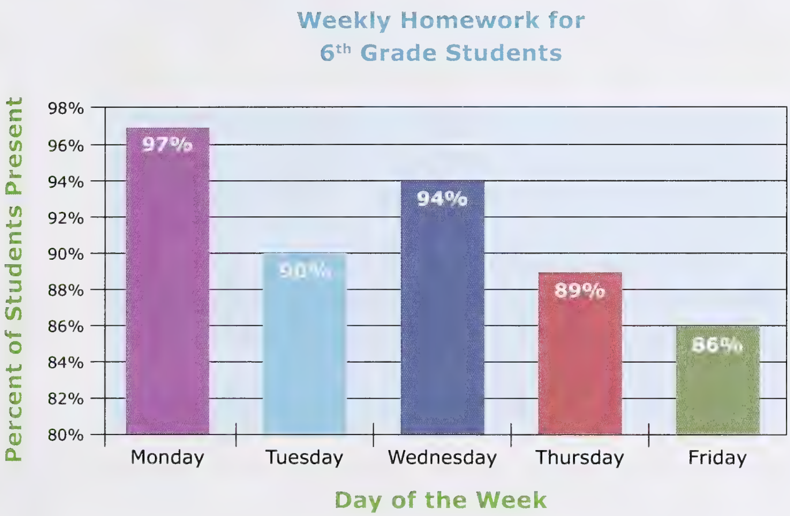
Graphing Data with Percents

You need to know when it is best to use different types of graphs. One type of graph that is often used with percents is a **circle graph**. These are used mainly when you are graphing all of the parts of a whole.

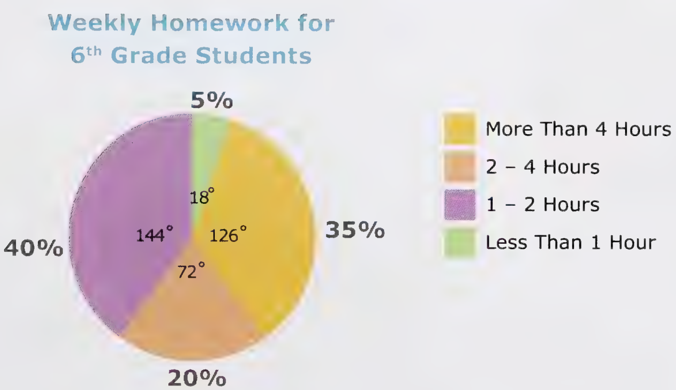


As you can see, the percents add up to 100% in a circle graph. All of the data is about the same situation.

When you are comparing percents you could use a bar graph. You can compare percents when looking at different groups or categories of a set. The percents do not have to add up to 100% since they are parts of different wholes.



To make a circle graph you must use a protractor. Each section of a circle graph is a percent of the 360° in a circle. The following circle graph is marked with the degree measure of each section:



Using Technology to Create Graphs

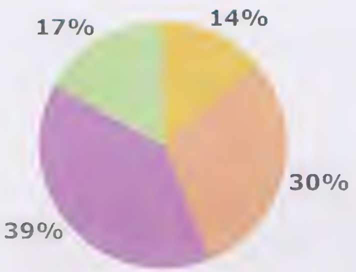
Another way of creating a graph is by using technology. Many software programs help you graph data using a **spreadsheet**. This is a table of values made up of rows and columns. The following data was created by asking 60 6th grade students how many after-school activities they participate in each week.

	A	B	C
1	**Weekly After-School Activities for 6th Grade Students**		
2	**Number of After-School Activities per Week**	**Number of Students**	
3	0	10	
4	1 to 2	21	
5	2 to 3	27	
6	more than 3	12	
7			

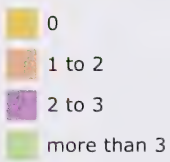
Once you have input your data, the computer can create a graph from the data. The computer will give you several types of graphs to choose from. You can choose the colours and styles for these graphs.

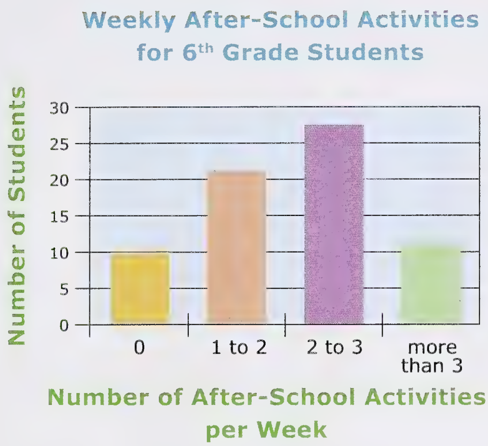
Here are two sample graphs created using the data on the previous spreadsheet.

Weekly After-School Activities for 6th Grade Students



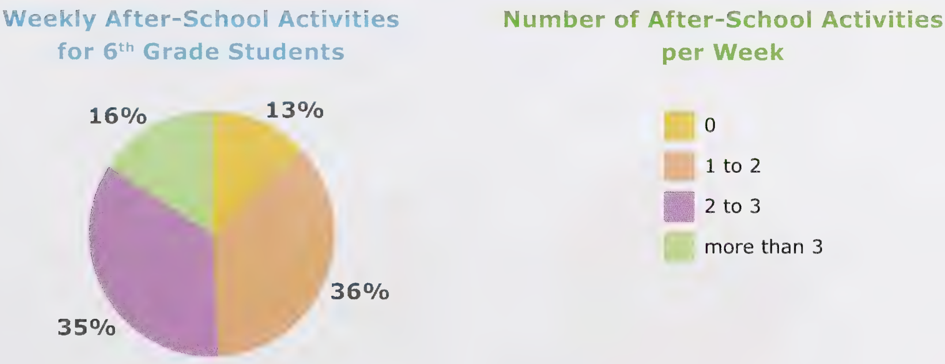
Number of After-School Activities per Week

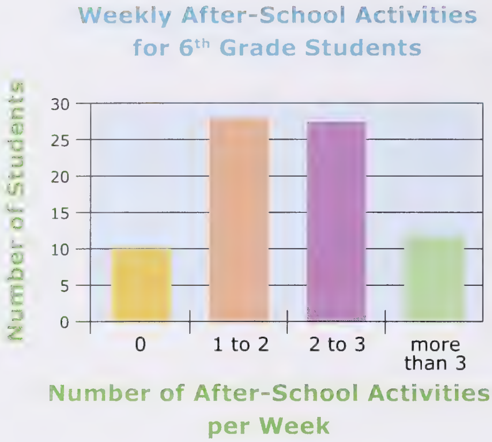




Even though the spreadsheet data had the actual number of students, the computer graph figured out the percentages for the circle graph. If you change one of the numbers in the data on the spreadsheet, the graphs will change as well:

	A	B	C
1	**Weekly After-School Activities for 6th Grade Students**		
2	**Number of After-School Activities per Week**	**Number of Students**	
3	0	10	
4	1 to 2	28	
5	2 to 3	27	
6	more than 3	12	
7			





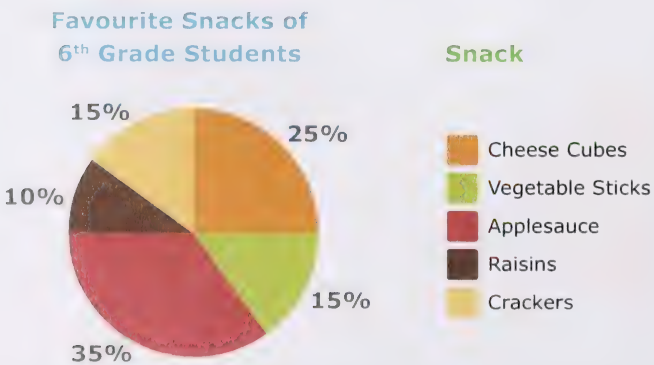
In the next Exploration you will decide which type of graph to use to display given data.

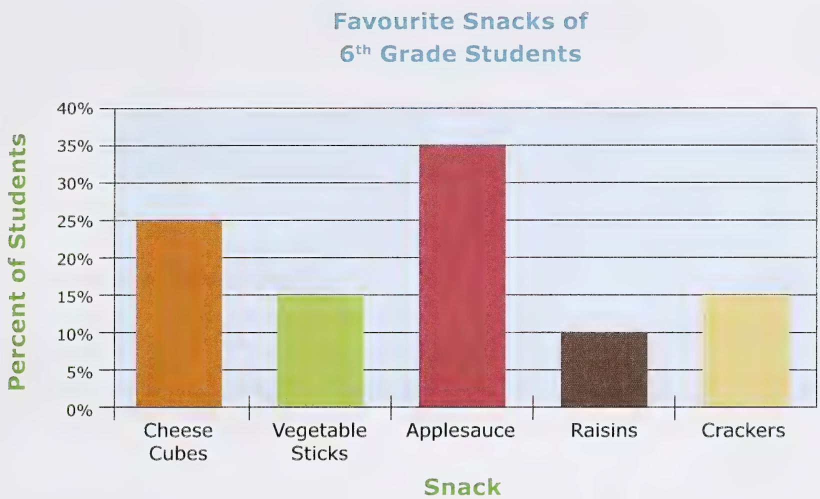
Let's Explore

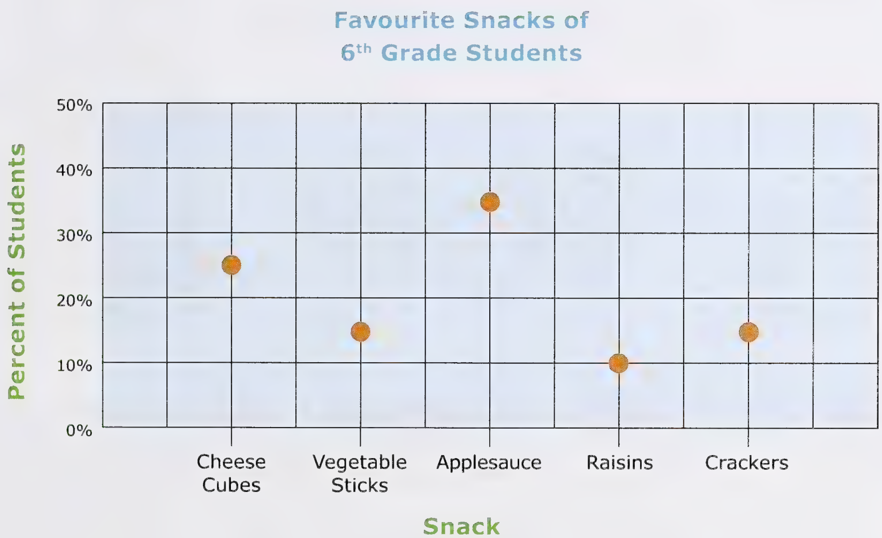
Exploration 2: Graphing Data

Materials: Unit 4, Lesson 5, Exploration 2 page in your Workbook, Pencil

For 1 – 4: You have just surveyed your classmates. Each graph displays the same collected data.







1. What percentage of students prefer each snack?
2. What is the favourite snack based on this data?
3. Which of the three graphs would you use to display your data?

For 4 – 5: Either record an oral response or write one in your Workbook. If recording, follow the recording instructions in your Workbook.

4. Explain why you chose that graph.

5. Reflect: What are some things you should think about when choosing the type of graph to display a set of data?

Let's Practice

- Turn in your Workbook to Unit 4, Lesson 5 and complete 1 to 15.
- Go online to complete the Concept Capsule: Creating Circle Graphs.

Math 6 Unit 4

Lesson 6

Possible Outcomes

Coin Toss Advantage

In the game of soccer the team that wins the coin toss gets to choose which goal they will attack in the first half. They also get to kick off the ball in the second half.

There are two possible things that can happen when you toss a coin:

Reflection

Do you think the coin toss is a fair way to make a decision like the soccer start for two teams?

What if there were three or more people and a decision that needed to be made?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- List the possible outcomes of a probability experiment
- Discover the counting principle

- Go online to watch the Notepad Tutor Lesson: Comparing Outcomes (Less Likely, Equally Likely, More Likely)

Outcomes

In probability there are **experiments** and **outcomes**. An experiment is a situation that has specific outcomes. An outcome is what happens as a result of the experiment.

There are two outcomes that can happen when you toss a coin:

Heads

OR

Tails

You should be able to tell the outcomes that may occur for any given experiment. When you are trying to list outcomes just ask:

> "What can happen if...?"

Conduct the following experiment and record outcomes.

Let's Explore

Exploration 1: Rolling Sums

Materials: Unit 4, Lesson 6, Exploration 1 page in your Workbook, A Pair of Six-Sided Dice, Pencil

1. Toss the dice. Record the sum of the two dice in the table provided in your Workbook.
   Repeat until all parts of the table are filled.
2. List the different outcomes.
3. What was the outcome that occurred the most?
4. What was the outcome that occurred the least?
5. Were there any possible outcomes that did not occur?
6. If you were to limit the number of dice that you rolled to one six-sided die, what are the possible outcomes?
7. If you roll three dice and find the sum, what are the possible outcomes?

Example 1

List the possible outcomes for the following situation:

Spinning the given spinner once

There are 5 sections on the spinner. All of the possible outcomes are:

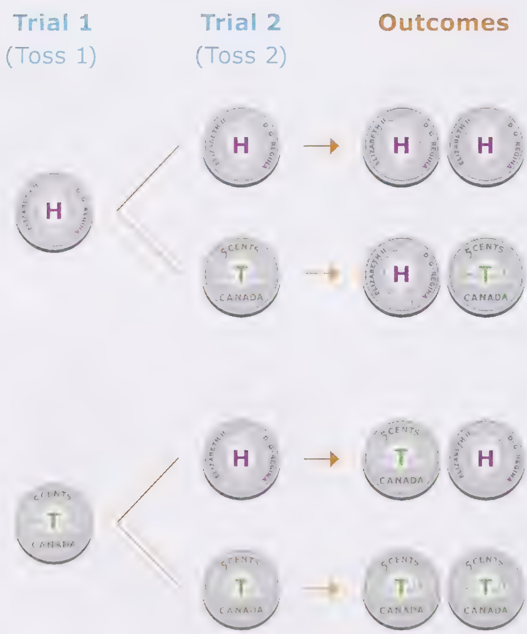
Blue 1, Yellow 3, Red 5, Blue 7, Red 9

Multiple Trials

You may conduct experiments that have two or more parts. The parts are called **trials**. The experiments are described using the outcomes of each trial. For instance, if you toss a coin twice, you may get a heads on the first toss and a tails on the second. You would describe that as: **Heads**, **Tails**, or use abbreviations: **HT**

You can use a tree diagram to help you list the outcomes when there are multiple trials.

Tossing a coin twice:



You list the outcomes for the first trial in a column. Then list the outcomes of the second trial in a column next to the first. You will list the outcomes of the second trial once for each outcome in the first column.

Example 2

List the outcomes for the following experiment:

Spinning the spinner then rolling a six-sided die

The spinner has 3 outcomes: Red, Green, or Blue

The die has 6 outcomes: 1, 2, 3, 4, 5 or 6

Make a tree diagram or list all of the outcomes.

In this tree diagram, R means Red, G means Green, and B means Blue:

Spinner	Roll of the Die	Outcomes
R	1	R1
	2	R2
	3	R3
	4	R4
	5	R5
	6	R6
G	1	G1
	2	G2
	3	G3
	4	G4
	5	G5
	6	G6
B	1	B1
	2	B2
	3	B3
	4	B4
	5	B5
	6	B6

The last column is the list of all possible outcomes for this experiment.

Do you notice a relationship between the number of outcomes and the number of choices for each trial in an experiment?

- Go online to complete the Concept Capsule: Listing Possible Outcomes.

Let's Explore

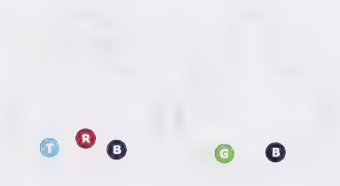
Exploration 2: Patterns in Outcomes

Materials: Unit 4, Lesson 6, Exploration 2 page in your Workbook, Pencil

For 1 – 6: List all the outcomes for each experiment: choosing from Bag 1 and then from Bag 2.

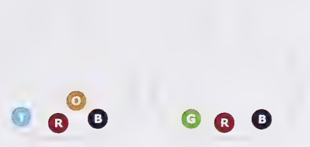
T = Turquoise, R = Red, B = Blue, O = Orange, G = Green

1.



2.

3.



4.

5.

6.

7. Use your answers from 1 – 6 to complete the table in your Workbook.
8. What is the relationship between the number of outcomes from each bag and the number of total outcomes?
9. If there are 12 marbles in Bag 1 and 8 marbles in Bag 2, how many possible outcomes are there?

Fundamental Counting Principle

The principle of probability that you discovered in Exploration 2 is called the **Fundamental Counting Principle**. If there is more than one trial in an experiment, then the number of possible outcomes for the experiment is the product of the number of outcomes for each trial.

Example 3

The lunch menu has two choices for sandwiches and three choices for side dishes:

Find the total number of outcomes.

You can list each combination:

Chicken, Apple	Tuna, Apple
Chicken, Celery	Tuna, Celery
Chicken, Carrots	Tuna, Carrots

Using the Fundamental Counting Principle:

There are 2 possible outcomes for the first choice.

There are 3 possible outcomes for the second choice.

Multiply the number of outcomes from each choice: $2 \bullet 3 = 6$

There are 6 possible outcomes for this situation.

Let's Practice

- Turn in your Workbook to Unit 4, Lesson 6 and complete 1 to 18.

Math 6 Unit 4

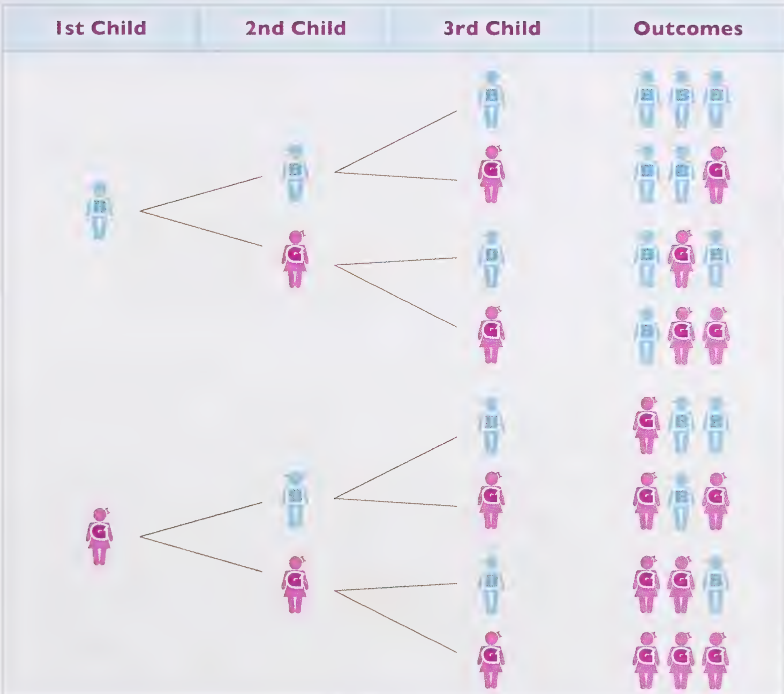
Lesson 7

Theoretical Probability

Gender in Families

In Canada, the 2006 census showed an average of 1.5 children per family. A family may plan to have three children. There is no way to know if the children will be boys or girls when a family plans for that number. You can figure out the probability that they will have a certain outcome.

Here is a tree diagram of the possible gender outcomes for a family that has three children:



You can see that there are 3 ways to have two girls:

BGG GBG GGB

There is only one way to have a girl, then a boy, then a girl:

GBG

The description of outcomes can become part of determining the probability of an event.

Reflection

How would you find the number of gender outcomes for a family that wants to have four children?

Objectives for this Lesson

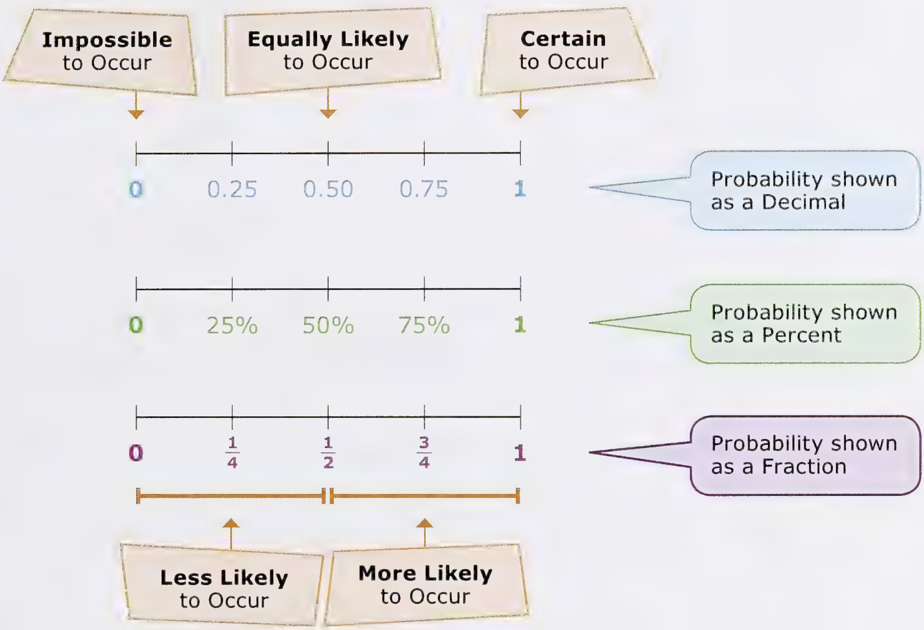
In this lesson you will explore the following concepts:

- Determine the theoretical probability of an outcome occurring for a given probability experiment
- Predict the probability of a given outcome occurring for a given probability experiment by using theoretical probability

Theoretical Probability

The chance that an **event** will occur is **theoretical probability**. The probability of an event is a ratio between 0 and 1, and includes 0 and 1.

The probability of an event is **1** if it is certain to occur. The probability of an event is **0** if it is impossible that it will occur. The likelihood of an event occurring may be shown using a simple number line.



Probabilities equal to 0.50, 50% or $\frac{1}{2}$ are equally likely to occur.
If they are greater than 0 and less than $\frac{1}{2}$ then they are less likely to occur.
A probability greater than $\frac{1}{2}$ and less than 1 is more likely to occur.

A probability of an event is the ratio of favourable outcomes to the number of possible outcomes. In symbolic form this sentence looks like this:

$$P(\text{event}) = \frac{\text{Number of Favourable Outcomes}}{\text{Number of Possible Outcomes}}$$

This is much like finding the fraction of a group.

Example 1

Find the probability of picking a red marble at random from the bag of marbles. Write the probability as a fraction, decimal and percent.

R = Red, B = Blue, G = Green

You need to identify two things:

- the number of favourable outcomes
- the number of possible outcomes

The red marbles are the favourable outcomes: 3 red marbles

Count all the marbles to get the number of possible outcomes: 12 marbles

P(red) means the probability of drawing a red marble.

$$P(\text{red}) = \frac{\text{Number of Red Marbles}}{\text{Number of Marbles}} = \frac{3}{12}$$

P(red) as a fraction: $\frac{3}{12}$

P(red) as a decimal: $3 \div 12 =$ **0.25**

P(red) as a percent: **25%**

Example 2

Find the probability of picking a green or blue marble at random from the bag of marbles. Write the probability as a fraction, decimal and percent.

R = Red, B = Blue, G = Green

In symbolic form you are trying to find:

P(green or blue) OR P(G or B)

The number of favourable outcomes is found by counting the green and blue marbles:

Green = 4 and Blue = 5 so there are 4 + 5 = **9** favourable outcomes.

The number of possible outcomes remains 12.

$$P(G \text{ or } B) = \frac{\text{Number of Green and Blue Marbles}}{\text{Number of Marbles}} = \frac{9}{12}$$

P(G or B) as a fraction: $\mathbf{\frac{9}{12}}$

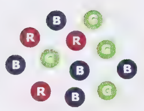
P(G or B) as a decimal: $9 \div 12 =$ **0.75**

P(G or B) as a percent: **75%**

Example 3

Find the probability of not picking a green marble at random from the bag of marbles. Write the probability as a fraction, decimal and percent.

R = Red, B = Blue, G = Green



In symbolic form you are trying to find: P(not green) OR P(not G)

The number of favourable outcomes is found by counting the red and blue marbles, since these are the ones that are NOT green:

Red = 3 and Blue = 5, so there are 3 + 5 = **8** favourable outcomes.

The number of possible outcomes remains 12.

$$\text{P(not G)} = \frac{\text{Number of Non-Green Marbles}}{\text{Number of Marbles}} = \frac{8}{12}$$

P(not G) as a fraction: $\mathbf{\frac{8}{12}}$

P(not G) as a decimal: $8 \div 12 \approx$ **0.67** (after rounding to the hundredths)

P(not G) as a percent: **67%**

Let's Explore

Exploration 1: Theoretical Probability

Materials: Unit 4, Lesson 7, Exploration 1 page in your Workbook, Pencil, Items such as a Pair of Six-Sided Dice, Spinners, Multi-Coloured Objects, Box or Bag, Coins

1. Create your own experiments that have the following probability:

   a. An experiment with an event that has a probability of $\frac{1}{12}$.

   b. An experiment with an event that has a probability of $\frac{5}{18}$.

   c. An experiment with an event that has a probability of $\frac{1}{4}$.

   d. An experiment with an event that has a probability of $\frac{7}{24}$.

For 2: Either record oral descriptions or write them in your Workbook. If recording, follow the recording instructions in your Workbook.

2. Describe each experiment and the event that you created, in words.

Probability When There is More Than 1 Trial

When there is more than one trial in an experiment it may be more challenging for you to tell the probability of an event. The probability must be described by the outcome of both trials.

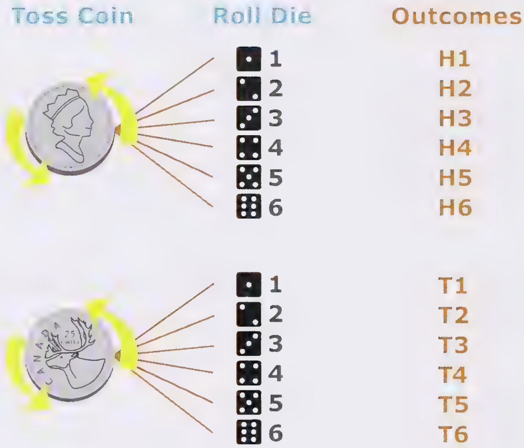
Daksha tosses a coin and rolls a six-sided die. The probability of tossing a head followed by rolling a 2 is written symbolically as P(H, 2).

Example 4

Alyssa tosses a coin and rolls a six-sided die. Find each of the following probabilities.

a. P(H, 3) b. P(H, even) c. P(T, 6) d. P(T, not 1)

You first need to list all possible outcomes. You can use a tree diagram:



There are 12 possible outcomes. Now you are ready to find the probabilities.

a. P(H, 3)

There is one outcome that is a head followed by a 3.

$$P(H, 3) = \frac{\text{Number of H, 3}}{\text{Number of Possible Outcomes}} = \frac{1}{12}$$

$$P(H, 3) = \frac{1}{12}$$

b. P(H, even)

There are three outcomes that are heads followed by an even number: H2, H4, H6

$$P(\text{H, even}) = \frac{\text{Number of H, even}}{\text{Number of Possible Outcomes}} = \frac{3}{12}$$

$$P(\text{H, even}) = \frac{3}{12}$$

c. P(T, 6)

There is one outcome that is a tail followed by a 6.

$$P(\text{T}, 6) = \frac{\text{Number of T, 6}}{\text{Number of Possible Outcomes}} = \frac{1}{12}$$

$$P(\text{T}, 6) = \frac{1}{12}$$

d. P(T, not 1)

There are five outcomes that are tails followed by a number that is not 1: T2, T3, T4, T5, T6

$$P(\text{T, not } 1) = \frac{\text{Number of T, not 1}}{\text{Number of Possible Outcomes}} = \frac{5}{12}$$

$$P(\text{T, not } 1) = \frac{5}{12}$$

You should be able to see that listing all possible outcomes can make finding probabilities much easier. The list allows you to quickly identify favourable outcomes.

Let's Practice

- Turn in your Workbook to Unit 4, Lesson 7 and complete 1 to 23.
- Go online to watch the Notepad Tutor Lesson: Solving Probability Problems Involving Two Independent Events.

Math 6 Unit 4

Lesson 8

Experimental Probability

Predicting the Weather

Skiers love fresh snow on the slopes. They have to rely on weather predictions to know which days to expect snow. Often, the weather report will be something like this:

Jasper National Park, February 27		
Today	Sunny with cloudy periods	High Minus 4
Tonight	Clear	Low Minus 20
Tomorrow	Sunny with a 30 percent chance of flurries late in the day	High Minus 1

This shows the predicted chance of rain or snow as a percent. This percent is in the "less likely" range for a probability.

Reflection

If you wanted to ski on fresh snow, would you ski tomorrow?

Lesson 8: Experimental Probability

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Conduct a probability experiment and compare the experimental results with the theoretical probability
- Explain the relationship between theoretical probability and experimental probability
- Distinguish between theoretical probability and experimental probability

Experimental Probability

When you conduct an experiment, the possible outcomes and the real outcomes can sometimes vary. When you toss a coin, what is the theoretical probability that you will toss a Head? You should be thinking:

$$P(\text{Head}) = \frac{\text{Number of Favourable Outcomes}}{\text{Number of Possible Outcomes}} = \frac{1}{2}$$

This is equivalent to 0.50 and 50%.

Lian tossed a penny ten times. Her outcomes were:

Lian tossed a Head 7 out of 10 times. That is $\frac{7}{10}$, **0.7** or **70%**.

Alyssa tossed a quarter ten times. Her outcomes were:

Alyssa tossed a Head 5 out of 10 times which is $\frac{5}{10}$, **0.50** or **50%**.

Reflection

Why do you think Lian's outcome differs from the theoretical probability?

Experimental probability is found by performing an experiment and recording the results. You will find the experimental probability using the ratio of the number of favourable outcomes to the total number of outcomes.

$$P(\text{event}) = \frac{\text{Number of Favourable Outcomes}}{\text{Total Number of Outcomes}}$$

If there are 100 trials in the experiment then the total number of outcomes is 100. This differs from theoretical probability:

Experimental Probability	Theoretical Probability
$P(\text{event}) = \frac{\text{Number of Favourable Outcomes}}{\text{Total Number of Outcomes}}$	$P(\text{event}) = \frac{\text{Number of Favourable Outcomes}}{\text{Number of Possible Outcomes}}$

Use the following Exploration to compare the experimental probability of an event to the theoretical probability of the same event.

Let's Explore

Exploration 1: Throwing a Six-Sided Die

Materials: Unit 4, Lesson 8, Exploration 1 page in your Workbook, Internet, Pencil

1. Go to the website: http://www.learnalberta.ca/content/memg/index.html
2. On the left, select **Grades 4 to 6**. If **Grades 4 to 6** is not there, click **Home** on the top left hand-side of the Mathematics Glossary page. Now click **Grades 4 to 6**.
3. Scroll down and select **Experimental Probability**.
4. This activity will help you explore the difference between theoretical and experimental probability. Use the first Demonstration Applet (Throwing the Six-Sided Die) and **Repeat Throwing the Die** until you have 25 throws.
5. Complete the table in your Workbook with the results of your experiment. Round your decimals to the hundredths place.
6. Observe the decimal equivalents of the theoretical probability and the experimental probability for 25 throws. What is the difference between P(4) for each?
7. Repeat 25 more throws until you have a total of 50 throws. Complete the table in your Workbook with the new results of your experiment. Round your decimals to the hundredths place.
8. Observe the decimal equivalents of the theoretical probability and the experimental probability for 50 throws. What is the difference between P(4) for each?
9. Repeat 25 more throws until you have a total of 75 throws. Complete the table in your Workbook with the new results of your experiment. Round your decimals to the hundredths place.
10. Observe the decimal equivalents of the theoretical probability and the experimental probability for 75 throws. What is the difference between P(4) for each?

11. Repeat 25 more throws until you have a total of 100 throws. Complete the table in your Workbook with the new results of your experiment. Round your decimals to the hundredths place.

12. Observe the decimal equivalents of the theoretical probability and the experimental probability for 100 throws. What is the difference between P(4) for each?

13. How does the difference in theoretical and experimental probability for P(4) change as the number of throws increases?

Example 1

Zach tossed a coin ten times. His results are recorded here:

Complete the given tables for the probability of tossing a head, H:

	Number of Favourable Outcomes	Number of Possible Outcomes	Probability as a Fraction	Probability as a Decimal	Probability as a Percent
Theoretical Probability					

	Number of Favourable Outcomes	Total Number of Outcomes	Probability as a Fraction	Probability as a Decimal	Probability as a Percent
Experimental Probability					

Start with the theoretical probability:

The number of favourable outcomes:

There is 1 head. 1

The number of possible outcomes:

There is 1 head and 1 tail. 2

The probability as a fraction:

$$P(\text{Head}) = \frac{\text{Number of Favourable Outcomes}}{\text{Number of Possible Outcomes}} = \frac{1}{2}$$

The probability as a decimal:

$1 \div 2 = 0.50$

The probability as a percent:

From the decimal, 50 parts of 100 is 50%

Now the experimental probability:

The number of favourable outcomes:

This is the number of heads that were tossed by Zach. 6

The number of outcomes:

This is the number of times Zach tossed the coin. 10

The probability as a fraction:

$$P(\text{Head}) = \frac{\text{Number of Favourable Outcomes}}{\text{Total Number of Outcomes}} = \frac{6}{10}$$

The probability as a decimal:

$6 \div 10 = 0.60$

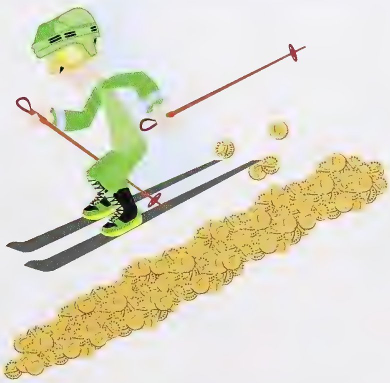
The probability as a percent:

From the decimal, 60 parts of 100 is 60%

Here are the completed tables:

	Number of Favourable Outcomes	Number of Possible Outcomes	Probability as a Fraction	Probability as a Decimal	Probability as a Percent
Theoretical Probability	1	2	$\frac{1}{2}$	0.50	50%

	Number of Favourable Outcomes	Total Number of Outcomes	Probability as a Fraction	Probability as a Decimal	Probability as a Percent
Experimental Probability	6	10	$\frac{6}{10}$	0.60	60%



Lesson 8: Experimental Probability

Let's Practice

- Go online to watch the Notepad Tutor Lesson: Theoretical vs. Experimental Probability.
- Turn in your Workbook to Unit 4, Lesson 8 and complete 1 to 12.
- Go online to Success Checker and complete the Unit test to check your understanding.
- Go online to play games that will help you review your glossary terms.

Sources - Student Learning Guide

Lesson 1
Page 4-1: Golden Ratio,
http://www.mscs.dal.ca/Fibonacci/

Lesson 3
Page 4-21: Hockey Results,
http://www.nhl.com/ice/teamstats.htm?navid=NAV|STS|Teams

Lesson 5
Page 4-35: Buffalo Jump,
http://www.royalalbertamuseum.ca/human/archaeo/aspects/buffalo.htm

Lesson 7
Page 4-57: Gender in Families,
http://www40.statcan.gc.ca/l01/cst01/famil50a-eng.htm

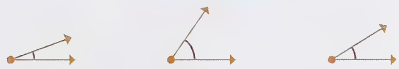
Lesson 8
Page 4-67: Predicting the Weather,
http://www.weatheroffice.gc.ca/

Glossary

A

acute angle: An angle whose measure is between 0 degrees and 90 degrees.

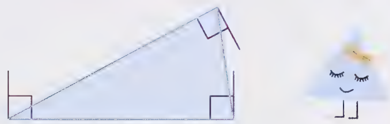
Acute Angles



acute triangle: A 3-sided polygon in which the measure of each interior angle is between 0 degrees and 90 degrees.

Acute Triangle

All angles are acute. (90°)



addition property of equality: The property that states that when the same number is added to both sides of an equation, the sides remain equal.

$$n - 5 = 12$$
$$n - 5 + 5 = 12 + 5$$
$$n = 17$$

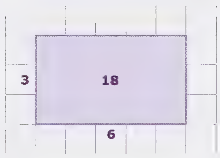
algorithm: A method that is used to solve a given problem.

angle: The figure made when two rays or line share a common endpoint.

Formed by Two Rays | Formed by Two Segments

area: The number of square units it takes to cover a shape.

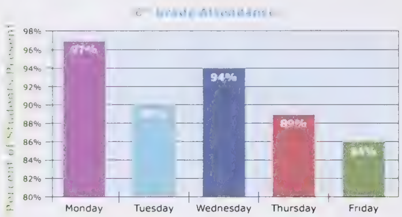
array: An arrangement of objects in rows and columns.



asymmetrical: A figure that does not have a line of symmetry.

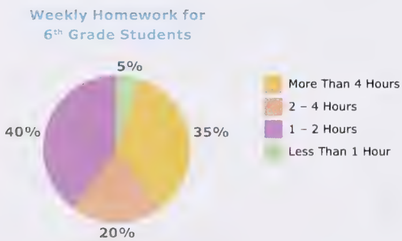
B

bar graph: A graph that displays data with separate bars that represent values in different categories.



C

circle graph: A graph that displays data, usually in percents, as sections of a circle. Sometimes called a 'pie chart'.



commutative property of addition: The property that states that the order in which two or more numbers are added can be changed and the sum will remain the same.

$5 + a = a + 5$

commutative property of multiplication: The property that states that the order in which two or more numbers are multiplied can be changed and the product will remain the same.

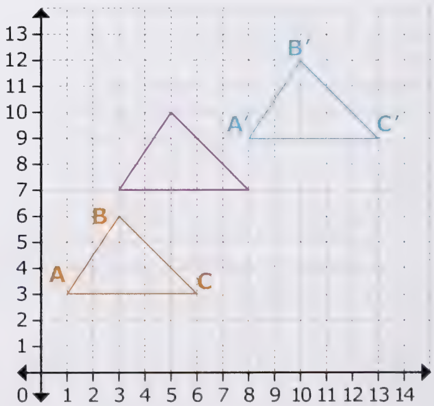
$4 \times 3 = 3 \times 4$

compatible numbers: An estimation strategy that uses numbers which are close to the original numbers in the problem to estimate a solution.

$127 + 238$
$= 130 + 240$
$= 370$

composite number: A counting number with more than two different whole number factors greater than 1.

composition of transformations: When two or more transformations are made in combination, or one after another.



congruent: Geometric figures (angles, lines, shapes, or objects) that are exactly the same in size and shape.

Congruent Triangles

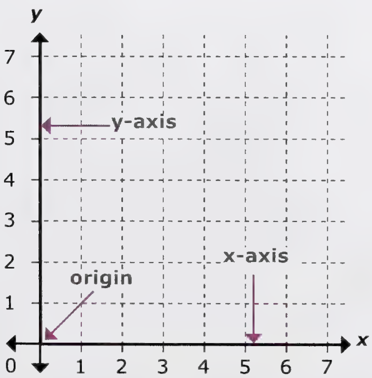
consecutive: Two numbers that follow each other in order.

7, 8, or 28, 29

continuous data: Information that changes over time, and doesn't stop within that time.

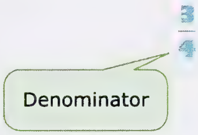
The speed of a bicycle as it coasts down a hill.

coordinate plane: A plane formed by a horizontal line (x-axis) that intersects a vertical line (y-axis).

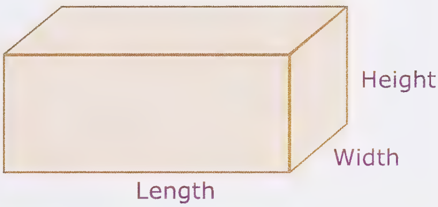


D

denominator: The number in a fraction that is below the fraction bar. It represents the total number of items in a group or the number of equal parts a whole is divided into.



dimensions: The measures used to describe the size of a 3D object or 2D shape.



discrete data: Information that can be counted.

The number of petals on different kinds of flowers.

distributive property: The property that states that multiplying a number by a sum is the same as multiplying a number by each number in the sum.

Multiplying by a Sum	Multiplying with Distributive Property
$4(15+8)$ $= 4(23)$ $= 92$	$4(15+8)$ $= 4(15) + 4(8)$ $= 60 + 32$ $= 92$

dividend: The number being divided in a division problem.

$$\begin{array}{r}14\\6\overline{)84}\end{array}$$

Dividend

division property of equality: The property that states that when both sides of an equation are divided by the same number, the sides remain equal.

$$6x = 18$$
$$\frac{6x}{6} = \frac{18}{6}$$
$$x = 3$$

divisor: The number by which you are dividing in a division problem.

$$\text{Divisor} \longrightarrow \begin{array}{r}14\\6\overline{)84}\end{array}$$

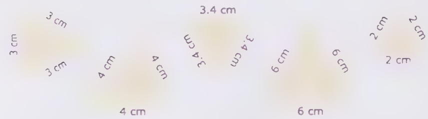
E

endpoint: A point that marks the start of a ray or the start and/or end a line segment.

equation: A math sentence showing two expressions that are equal.

$$x + 3 = 9$$

equilateral triangle: A 3-sided polygon in which all of the sides are the same length.



event: One or more outcomes of a probability experiment. For example: Flipping a coin and tossing a die to get a head and a four.

$$\underbrace{P(H, 4)}_{\text{event}}$$

expanded form: A number written as a sum with the value of each digit shown.

$$156 = \underbrace{100 + 50 + 6}_{\text{Expanded Form}}$$

experiment: An activity that results in an outcome, For example: The flip of a coin.

experimental probability: The likelihood of an event happening based on results from an experiment or simulation.

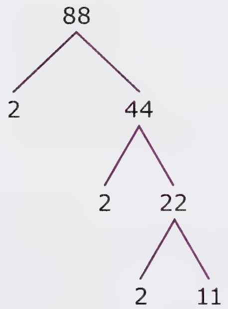
expression: A mathematical phrase that combines operations, numbers and/or variables.

$$2 + n$$

F

factor: A number that evenly divides into a given number.

factor tree: A diagram used to show all of the prime factors of a given number by writing each composite number as a pair of its prime factors; the final picture often has a tree shape.

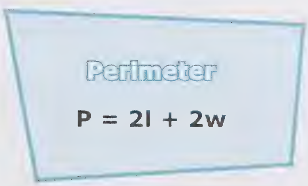


Fibonacci sequence: A sequence of numbers that is based on many things in nature. The first two numbers are 0 and 1, and each remaining number is the sum of the previous two.

Fibonacci sequence:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89...

formula: An equation that shows the relationship among specific numbers/variables.



function rule: An expression that relates an input number to its output number.

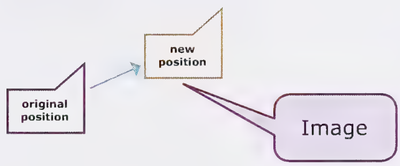
Input	Work	Output
n	(n) + 3	n + 3
1	(1) + 3	4
2	(2) + 3	5
3	(3) + 3	6
4	(4) + 3	7
5	(5) + 3	8

Function Rule
n + 3

fundamental counting principle: The number of possible outcomes for all probability experiments is the product of the outcomes for each experiment.

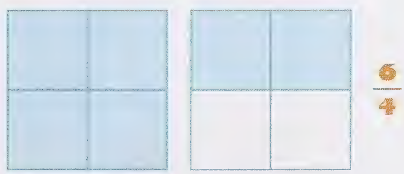
I

image: The new position of the original figure after a transformation is made.



improper fraction: A fraction in which the numerator is greater than the denominator.

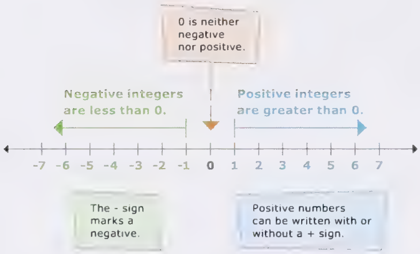
Improper Fraction



inequality: A mathematical sentence that shows the relationship between quantities that are not equal. The symbols used are "not equal to" (≠), "less than" (<), and "greater than" (>).

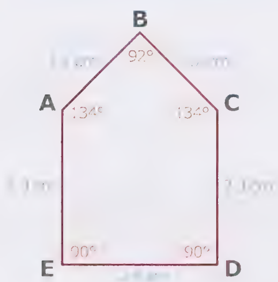
≠ < >

integer: Any number in the set of counting numbers, zero, and the opposite of the counting numbers.

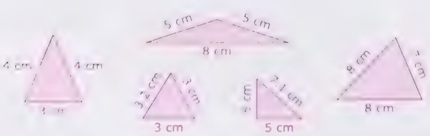


irregular polygon: A polygon in which not all sides have the same length, and not all interior angles have the same measure.

Irregular Pentagon

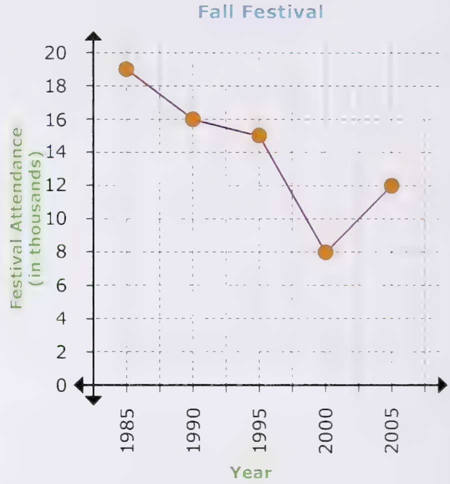


isosceles triangle: A 3-sided polygon in which two of the sides are the same length.

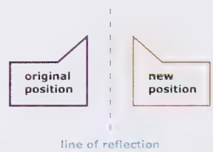


L

line graph: A graph made by connecting the plotted points with line segments showing how values change over time.

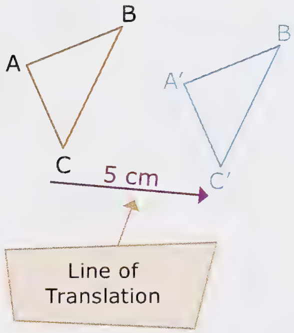


line of reflection: The line through which the pre-image is reflected to make its image.



line of symmetry: A line that shows where a figure may be folded exactly on top of itself.

line of translation: A ray that shows the distance and direction a pre-image is moved to its new location during a translation.

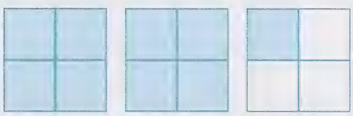


long division: A process for dividing two numbers using steps written out in full.

$$\begin{array}{r} 14 \\ 6\overline{)84} \\ \underline{6} \\ 24 \\ \underline{24} \\ 0 \end{array}$$

M

mixed number: A combination of a whole number and a fraction.



$2\frac{1}{4}$

multiple: A natural number that is the product of a given natural number and another natural number.

Mulitiples of 3: $\underbrace{3, 6, 9, 12...}_{\text{Multiples}}$

multiplication property of equality: The property that states that when both sides of an equation are multiplied by the same number, the sides remain equal.

$$\frac{x}{10} = 8$$

$$\frac{x}{10} \bullet 10 = 8 \bullet 10$$

$$x = 80$$

multiplier: A number that another number is multiplied by.

$3 \times \Delta = 21$

3 is the multiplier

N

number operation: A calculation performed by adding, subtracting, multiplying or dividing numbers.

Four Basic Operations

Addition: +
Subtraction: −
Multiplication: x
Division: ÷

numerator: The number above the bar in a fraction. It describes the number of parts of the whole or the number of items of interest in a set.

$\frac{3}{4}$ Numerator

O

obtuse angle: An angle whose measure is between 90 degrees and 180 degrees.

Obtuse Angles

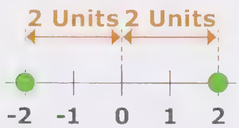
obtuse triangle: A 3-sided polygon in which the measure of one interior angle is between 90 degrees and 180 degrees.

Obtuse Triangle

One angle is obtuse. (> 90°)

opposites: Two integers that are the same distance, but in different directions, from zero on a number line.

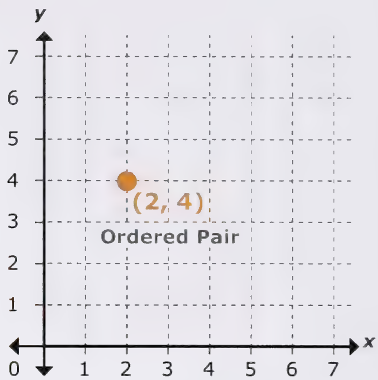
-2 is the opposite of +2



order of operations: A set of rules that defines the order in which we perform operations to simplify an expression.

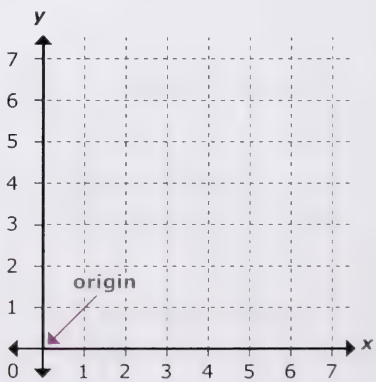
1. Parentheses
2. Multiply and Divide
3. Add and Subtract

ordered pair: A combination of two numbers used to locate a point on the coordinate plane.



orientation: The direction an object is facing.

origin: The location at the centre of the coordinate plane where the x-axis and y-axis cross. The coordinates of the origin are (0, 0).

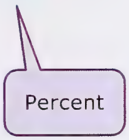


outcome: A result from a probability experiment. For example: Flipping a coin and tossing a die results in a head and a four.

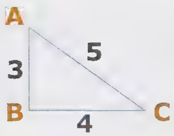
P

percent: A ratio that compares parts to 100 or per one hundred.

23 out of 100 = 23%

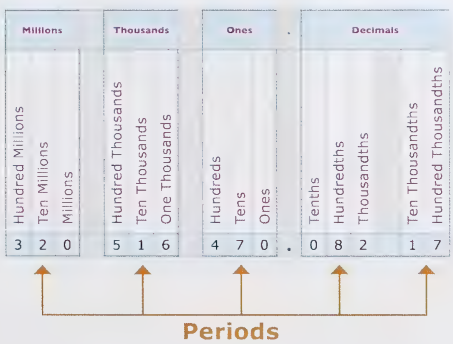


perimeter: The distance around a shape.

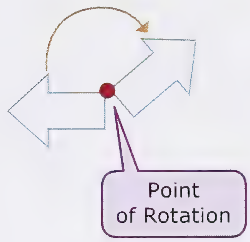


The perimeter is 3 + 4 + 5 or 12 Units

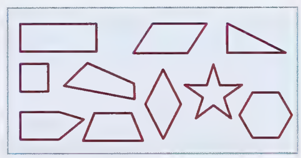
period: A group of 3 digits in a number greater than 100. Each period is separated by a space when written in standard form.



point of rotation: The point about which a pre-image is turned to make the image.

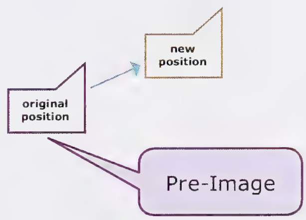


polygon: Closed shapes made of three or more straight line segments that do not cross.



population: All the members of a group that is being studied.

pre-image: The original figure in a transformation.



prime: A mark, similar to an apostrophe, used to label the new position of a point when transformed from the pre-image to the image.

prime factorization: Writing a composite number as a product of its prime factors.

84 = 2 x 2 x 3 x 7

prime number: A counting number greater than 1 that has exactly two different whole number factors, 1 and itself.

Prime: 3

Not Prime: 6

product: The answer to a multiplication problem.

100 x 5 = 500

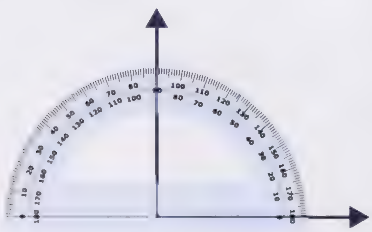
Product

proper fraction: A fraction in which the numerator is less than the denominator.

Proper Fraction

$\frac{3}{4}$

protractor: An instrument for measuring the size of an angle in degrees. One degree equals 1/360th of a circle.



Q

quadrilateral: A four-sided polygon.

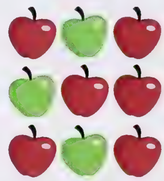
quotient: The answer to a division problem.

Quotient → 14

$6\overline{)84}$

R

ratio: A comparison of two related items.

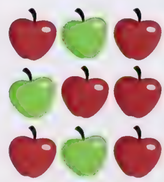


Green Apples to **Red Apples**

$\frac{3}{6}$

3:6

ratio in fraction form: A comparison of two related items, written as a fraction, with the first number being compared in the numerator, and the second number in the denominator.



Green Apples to **Red Apples**

Number of green apples

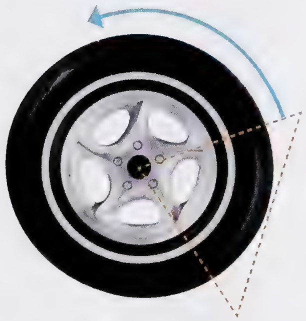
$\frac{3}{6}$

Number of red apples

ratio in ratio form: A comparison of two related items, using a colon.

ratio in word form: A comparison of two related items, using the word "to".

rotational symmetry: When turning a figure less than 360 degrees about a fixed point, the result in the turned figure matches the original figure.



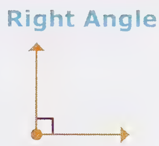
ray: Half of a line. It has one endpoint and continues forever in one direction.

rectangular prism: A 3D object that has bases that are congruent rectangles.

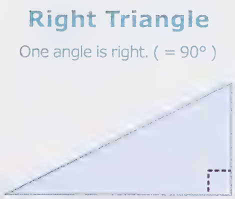
reflection: A transformation that creates a mirror image of a figure through a given line.

regular polygon: A polygon in which all sides are the same length and all interior angles have the same measure.

right angle: An angle measuring 90 degrees.



right triangle: A 3-sided polygon in which the measure of one interior angle is 90 degrees.

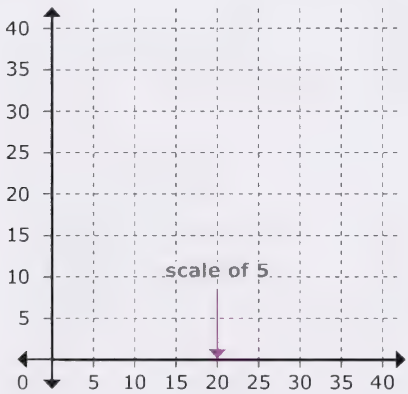


rotation: A transformation that turns a figure about a fixed point.

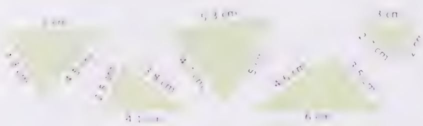
S

sample: A part of the population used to make predictions about the entire population.

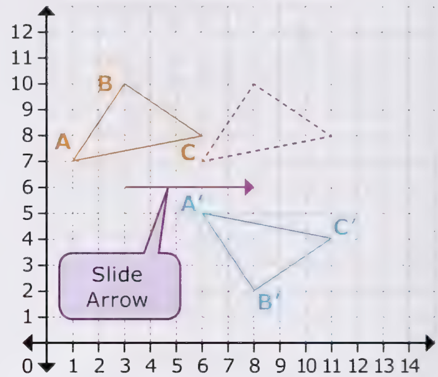
scale: The increment used between the numbers shown on a number line.



scalene triangle: A 3-sided polygon in which none of the sides are the same length.



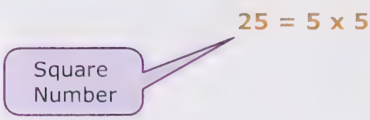
slide arrow: A ray that is used to combine both a translation and reflection, called a glide reflection.



spreadsheet: A document produced using a computer program. The program performs calculations on numbers arranged in rows and columns.

A	B	C
Weekly After-School Activities for 6th Grade Students		
Number of After-School Activities per Week	**Number of Students**	
0	10	
1 to 2	21	
2 to 3	27	
more than 3	12	

square number: The product of a number and itself.



standard form: A number written with a space between each period.

The number one thousand two hundred forty-three is 1 243.

[illegible]	[illegible]	Tens	Ones
1	2	4	3

straight angle: An angle measuring 180 degrees.

Straight Angle

straight edge: Any tool used to make straight lines. A ruler is an example of a straight edge.

subtraction property of equality: The property that states that when the same number is subtracted from both sides of an equation, the sides remain equal.

$$n + 5 = 12$$
$$n + 5 - 5 = 12 - 5$$
$$n = 7$$

T

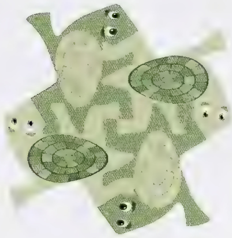
term: Each individual item in a collection of items or pattern.

$$\underbrace{\text{M, T, W, T, F, S, S, M, T, W...}}_{\text{Terms}}$$

Week	Nina's savings (in dollars)
4	48
5	60
6	72
7	84
8	96
9	108

Terms

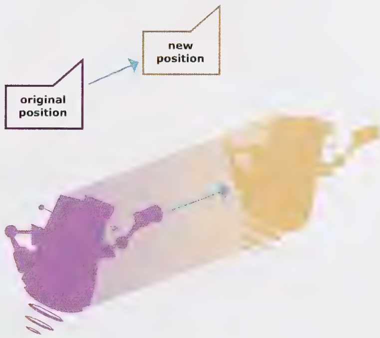
tessellation: A repeating pattern of interlocking shapes.



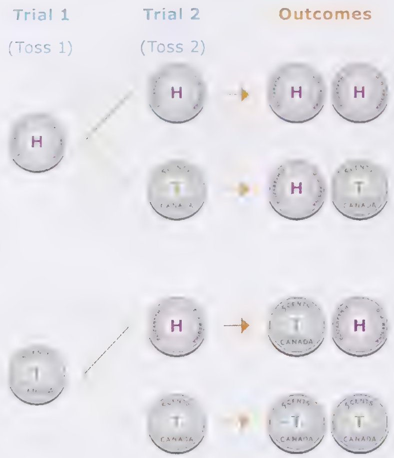
theoretical probability: The expected likelihood of an event happening that is determined on the basis of reasoning (not through repeated experiments).

transformation: A change in the position or orientation of a shape.

translation: A transformation that moves a figure along a straight line.



tree diagram: A diagram used to map the outcomes of a probability experiment.



trial: The number of times an event is repeated. For example: Rolling a die six times = 6 trials

V

variable: A symbol or letter used to represent a number.

2 + n

n is a variable

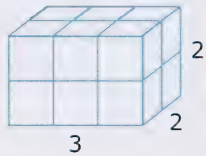
Venn diagram: A diagram that uses circles and overlapping regions to visually show how sets are related.

vertex: A common endpoint of two sides of a polygon, or three edges of a three-dimensional object.

A is a vertex of the triangle

volume: The amount of space a solid occupies.

The volume is 12 cubic units.



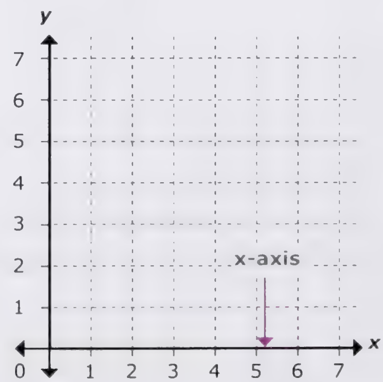
W

whole number: Any number in the set of numbers starting with zero and increasing by one.

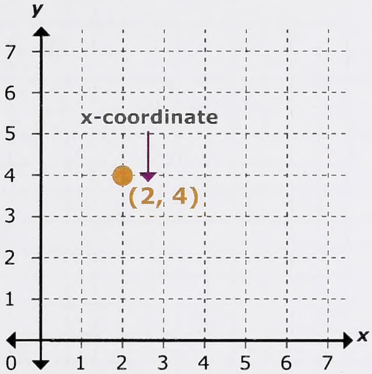
$\underbrace{0, 1, 2, 3...}_{\text{Whole Numbers}}$

X

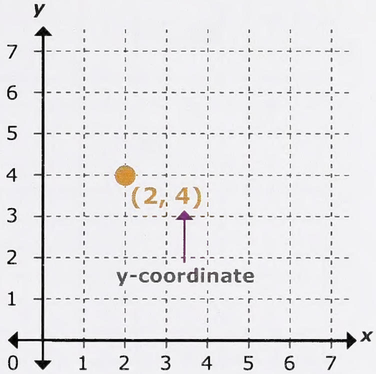
x-axis: The horizontal number line of a coordinate plane.



x-coordinate: The first number in an ordered pair that gives a point's horizontal distance from the origin.

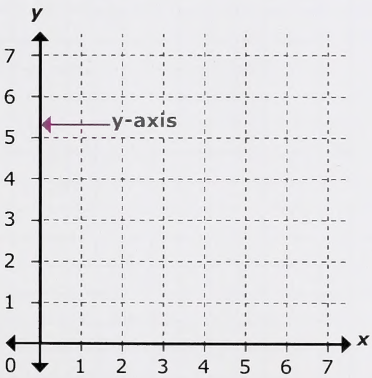


y-coordinate: The second number in an ordered pair that gives a point's vertical distance from the origin.



Y

y-axis: The vertical number line of a coordinate plane.



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